UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2017/2018
MASTER'S DEGREE (MSC)	MECHANICAL ENGINEERING
SUBJECT	MATERIAL CHARACTERISATION ACTIVITY
TYPE OF EDUCATIONAL ACTIVITY	F
AMBIT	21265-Tirocini formativi e di orientamento
CODE	17216
SCIENTIFIC SECTOR(S)	
HEAD PROFESSOR(S)	PITARRESI GIUSEPPE Professore Ordinario Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	3
INDIVIDUAL STUDY (Hrs)	48
COURSE ACTIVITY (Hrs)	27
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Pass/Fail
TEACHER OFFICE HOURS	**PITARRESI GIUSEPPE** Tuesday 14:00 15:30 Ufficio del docente (stanza O119) ubicato Edificio 8 primo piano plesso dell'Ex Istituto di Costruzione di Macchine (in fondo al corridoio centrale). Thursday 14:00 15:30 Ufficio del docente (stanza O119) ubicato Edificio 8 primo piano plesso dell'Ex Istituto di Costruzione di Macchine (in fondo al corridoio centrale).

DOCENTE: Prof. GIUSEPPE PITARRESI

PREREQUISITES	A basic knowledge of the below listed subjects is advised: - Maths: Tensorial Calculus, Trigonometry, - Phisics: basic notions of Electrical Circuits, notions of Heat Transfer by conductivity and irradiance. - Statistics: basic knowledge of statistical treatment of data. Accuracy, Precision and Bias of instruments. - Mechanics of Continuum: Stress and Strain Tensorial formulations and relationships, Generalised Hook's law. - Mechanics of Materials: Ductile and brittle behaviour, basic Fracture Mechanics, Static and Fatigue strength behaviours.
LEARNING OUTCOMES	Knowledge and comprehension of students will learn about the typology and features of principal Mechanical Testing Machines, and will be able to identify the best experimental setup for the evaluation of specific mechanical behavior. Students will be able to propose different measuring strategies and setups based on the material type (distinguish between metals, polymers, ceramics, composites) and and material property (distinguish between static/dynamic and stiffness/strength properties). Students will also be able to interpret and comprehend the typical requirements of standardized procedures, according to the most important standardization codes (e.g. ASTM, ISO, etc..) for the characterization of materials. Ability to: From the theoretical knowledge and comprehension of the experimental techniques, and through the lab activities, students will gain the ability to: - Select the most appropriate standard experimental setup based on the material/component to analyse and information to retrieve; - choose and setup the instrumentation for the specific parameter to be measured; - perform the measurements; - record and classify data and results from testing; - present data through reports.
ASSESSMENT METHODS	Only one oral examination session is required. Attendance of the course is considered an important prerequisite to access examination. In particular attendance of the 80 % of lab hours is considered essential. In fact the experience gained in the lab is unique and hardly achievable by any self-preparation. Furthermore the report on the lab activities, to be prepared by each student singularly, will be subject to evaluation. Students who book for their examination must submit their report on lab activities to the lecturer with at least one week advance from the day of the exam. The report can also be provided in electronic version by email. A typical exam session will last between 30, and will be structured as follows: - two questions on theroretical aspects of the characterisation of the mechanical behaviour of materials; - overview of the lab report together with the examiner. The following aspects of the exam performance will be considered and marked by the lecturer: a) The level of details and ability to make comparisons and links among techniques, among solutions and with experiences learned during the lab activities; b) The clearness of the answer and proper use of technical terminology; c) The effectiveness of using graphical representations as a tool to deliver the answer; d) The quality of the lab report: completeness, rigor of data post-processing, originality/effectiveness in graphical presentation of the report. Please notice that the exam final evaluation is not a mark but a passe/not-passed verdict.
EDUCATIONAL OBJECTIVES	The course wants to provide knowledge on techniques and approaches for the experimental characterization of the mechanical behavior of materials. Students attending the course will learn how to choose and setup an experimental procedure for the evaluation of a specific structural materials (metallic, polymer, ceramic, composite) and specific behaviors (isotropic/ orthotropic, static/dynamic, stiffness/strength, fracture toughness, etc..). The course will provide the knowledge on how to choose the type of testing machine, setup the most appropriate measurement instrumentation, and perform data collection and processing for the evaluation of standard mechanical and design parameters.

TEACHING METHODS	The whole course comprises 16 hours of lectures and 11 hours of laboratory activities for a total of 27 hours (9 hours per credit for a total of 3 credits). The whole 54 hours are typically delivered in about 5.5 weeks, with 5 hours per week. Lectures will consist of oral presentations assisted by the contemporary use of multimedia power-point projection and checkboard. Lab activities will be held in the "Laboratorio Prova Materiali e Componenti" of the DICGIM department (O002). Here students will find and be introduced to some common testing facilities for materials mechanical testing, such as electro-mechanic and servo-hydraulic universal testing machines and typical accessories and transducers for the characterization of the mechanical behavior of materials and structures.
SUGGESTED BIBLIOGRAPHY	1)G. Pitarresi – Appunti e slides del corso, materiale didattico interno disponibile on line. 2)Norme Internazionali relative a prove di Trazione e Flessione su materiali anisotropi. The lecturer's slides and notes [3] will be available from a web cloud. A link to such web cloud will be provided by the lecturer to all students attending the class.

SYLLABUS

Hrs	Frontal teaching
3	Sttress and Strain tensors and basic principles of theory of Elasticity
1	Generalised Hook's law for anisotropic media
2	Basics on strength of structural materials: brittle and ductile behavior, static and fatigue strength.
1	General overview of standard tests for the mechanical characterization of materials
1	Standards on the Mechanical characterisation of materials
3	Tensile behaviour characterisation of isotropic and anisotropic materials - theory
1	Ramberg-OIsgood and Exponential Strain hardening laws
3	Theory of flexural and shear tests
1	Variable span flexural tests and ASTM standards

Hrs	Workshops
2	Description of the principal universal testing machines and accessories for the measurement of mechanical parameters
4	Implementation of tensile tests on metallic, polymer and polymer composite materials (execution of tensile tests on servo-hydraulic and electro-mechanic testing machines)
1	Implementation of a tensile test on aluminum alloy samples to define the hardening law
4	Implementation of flexural tests on metallic, polymer and polymer composite materials